

FIG. 1 prior art

| | | | |
|---|-------|------|--------|
| ① | Load | r8, | 0x1000 |
| ② | Load | r9, | 0x1500 |
| ③ | Store | r10, | 0x1760 |
| ④ | Load | r11, | 0x1840 |
| ⑤ | Load | r12, | 0x1760 |

the same address

instructions (1), (2) and (4) : no dependency : replaceable

instructions (3) and (5) : dependency : the order (3) → (5)

examples of replacing

③. ①. ②. ④. ⑤ ①. ②. ④. ③. ⑤

FIG. 2 prior art

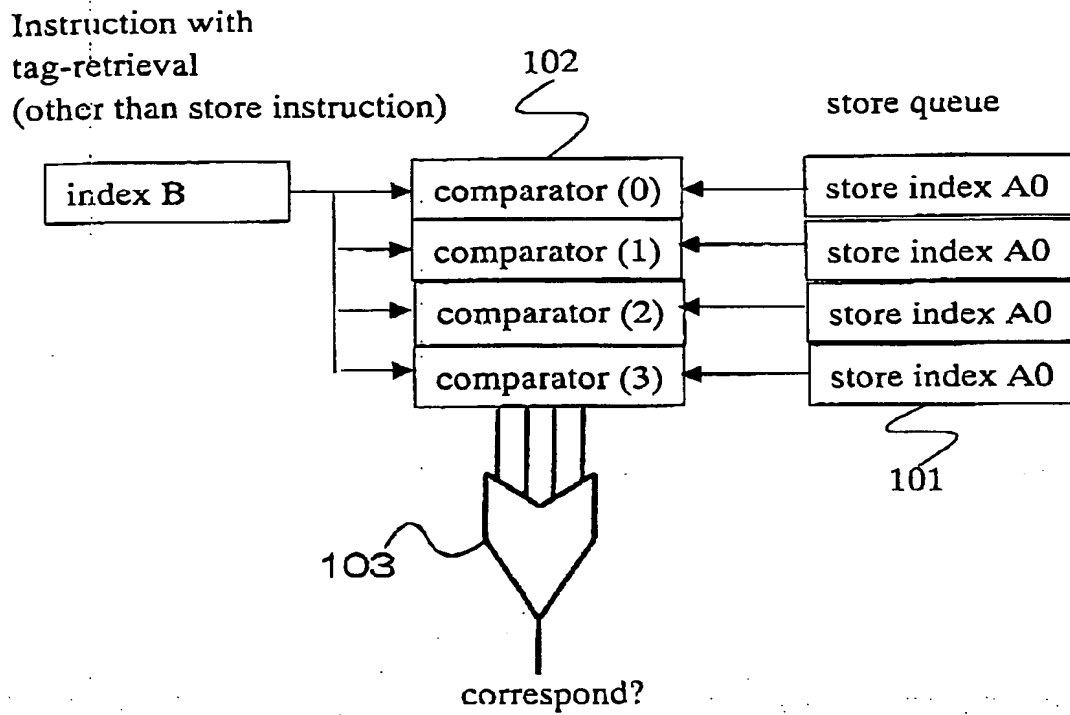


FIG. 3 prior art

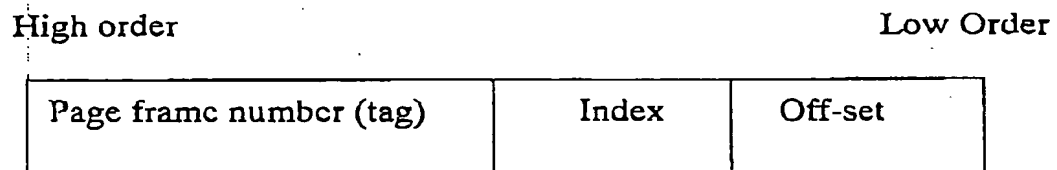


FIG. 4 prior art

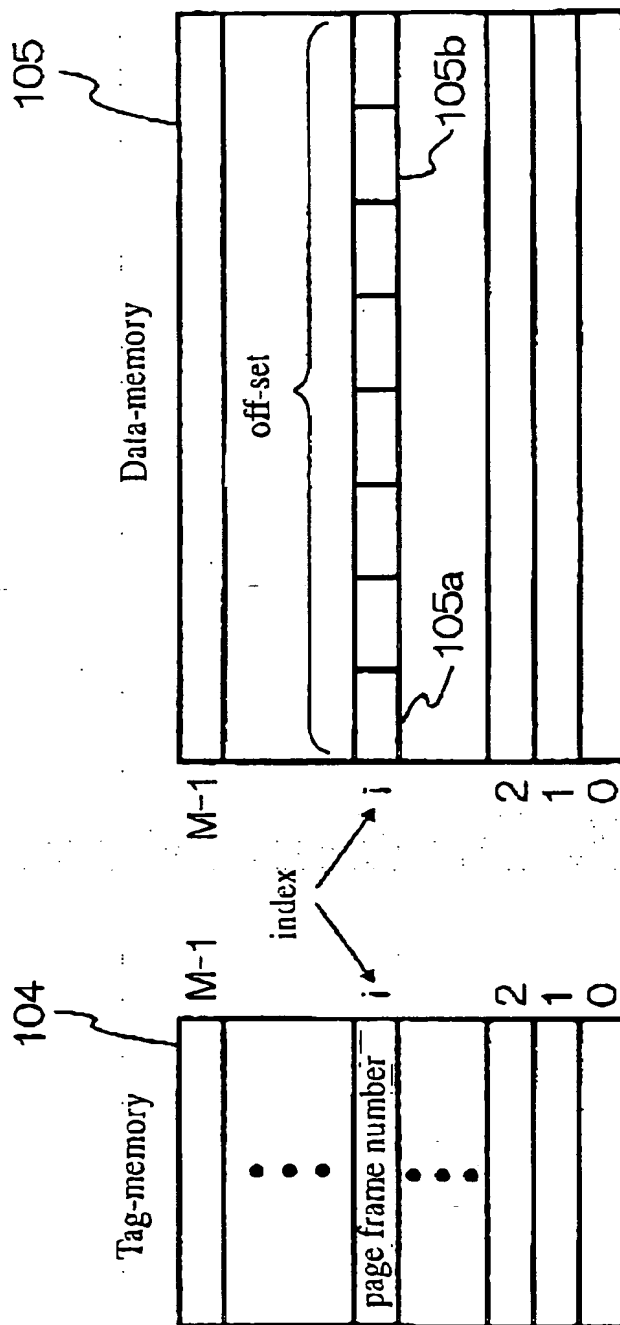
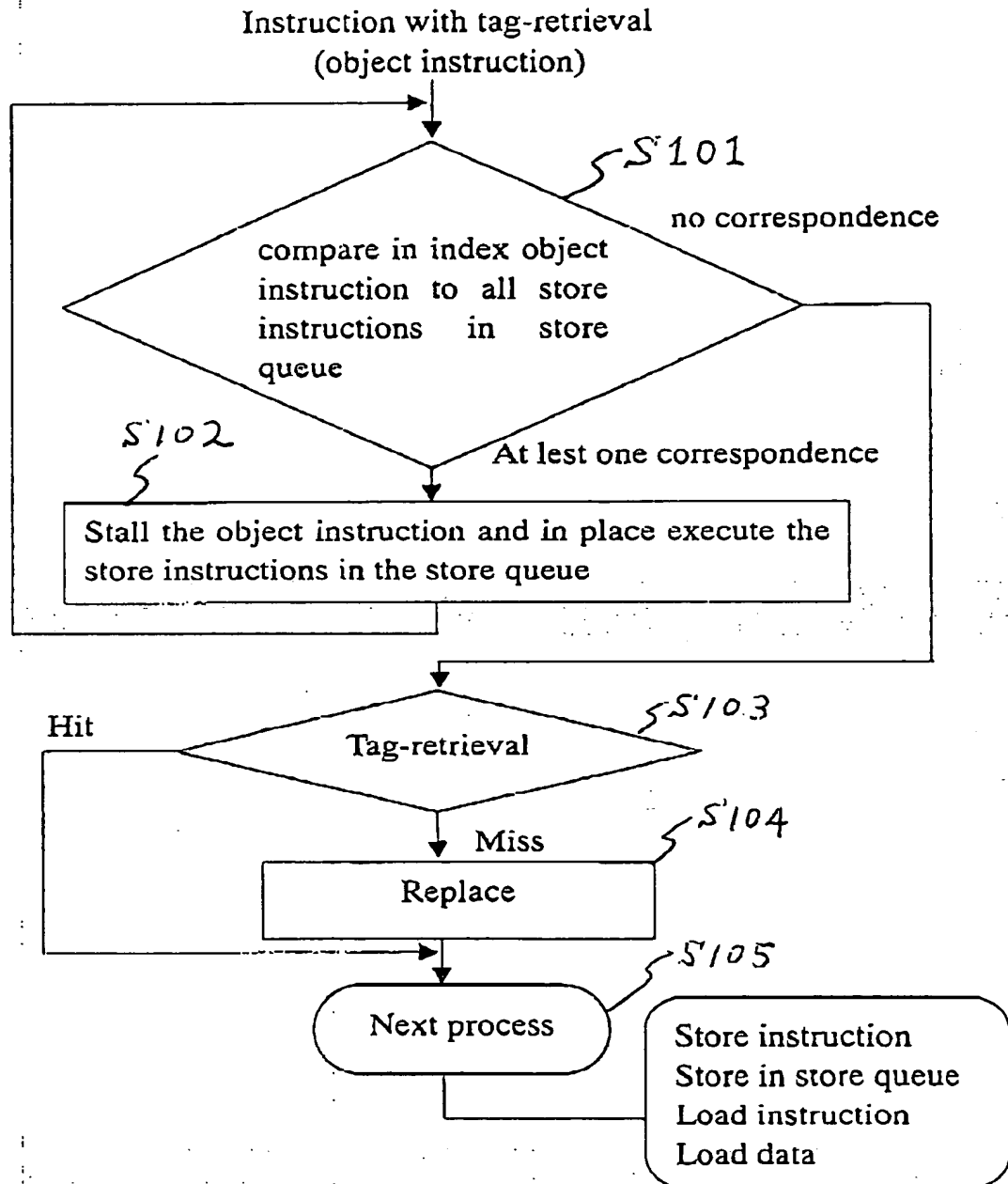


FIG. 5 prior art



1058771.013002

FIG. 6

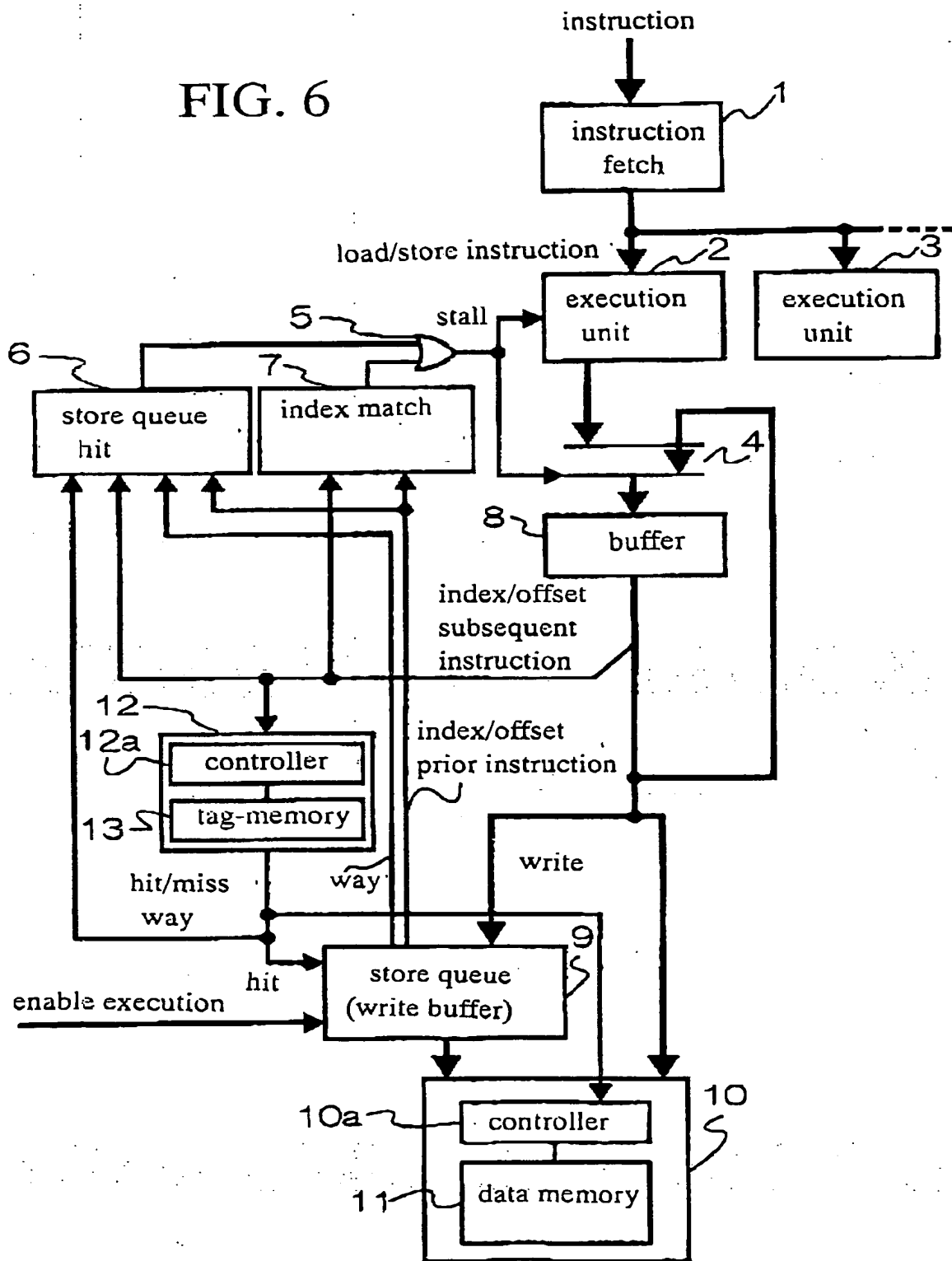


FIG. 7

9

| ID | page frame number | index | off-set | way | ... |
|-----|-------------------|-------|---------|-----|-----|
| 0 | | | | | ... |
| 1 | | | | | ... |
| 2 | | | | | ... |
| ⋮ | ⋮ | ⋮ | ⋮ | ⋮ | ⋮ |
| n-1 | | | | | ... |

10058771.013002

FIG. 8

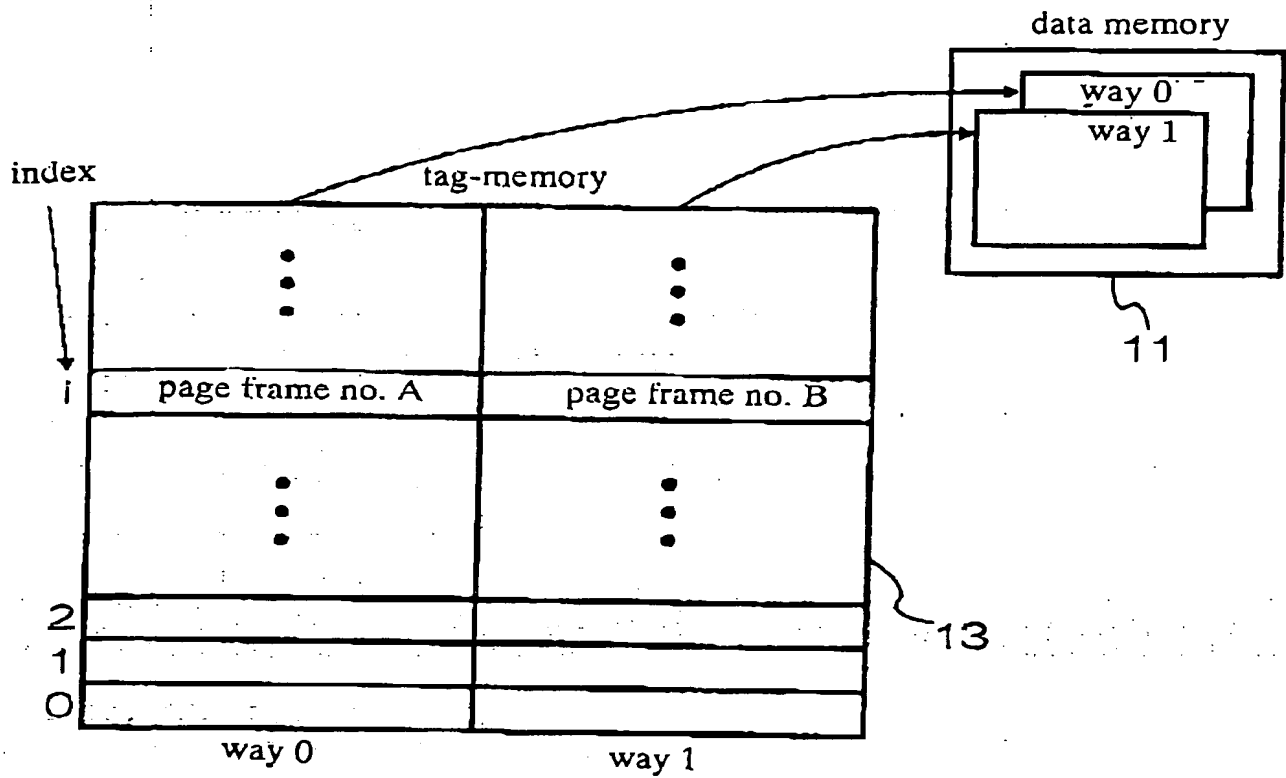
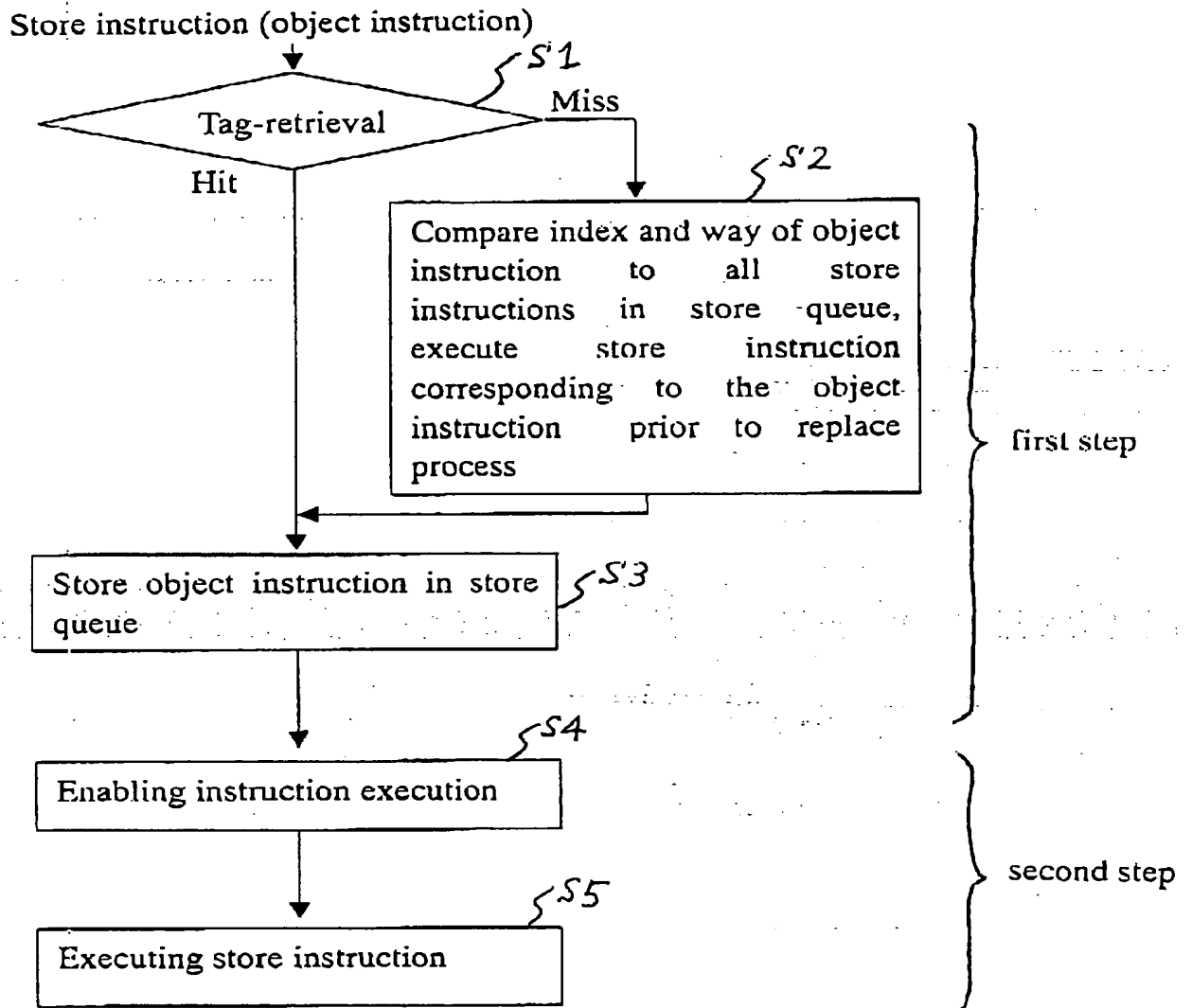
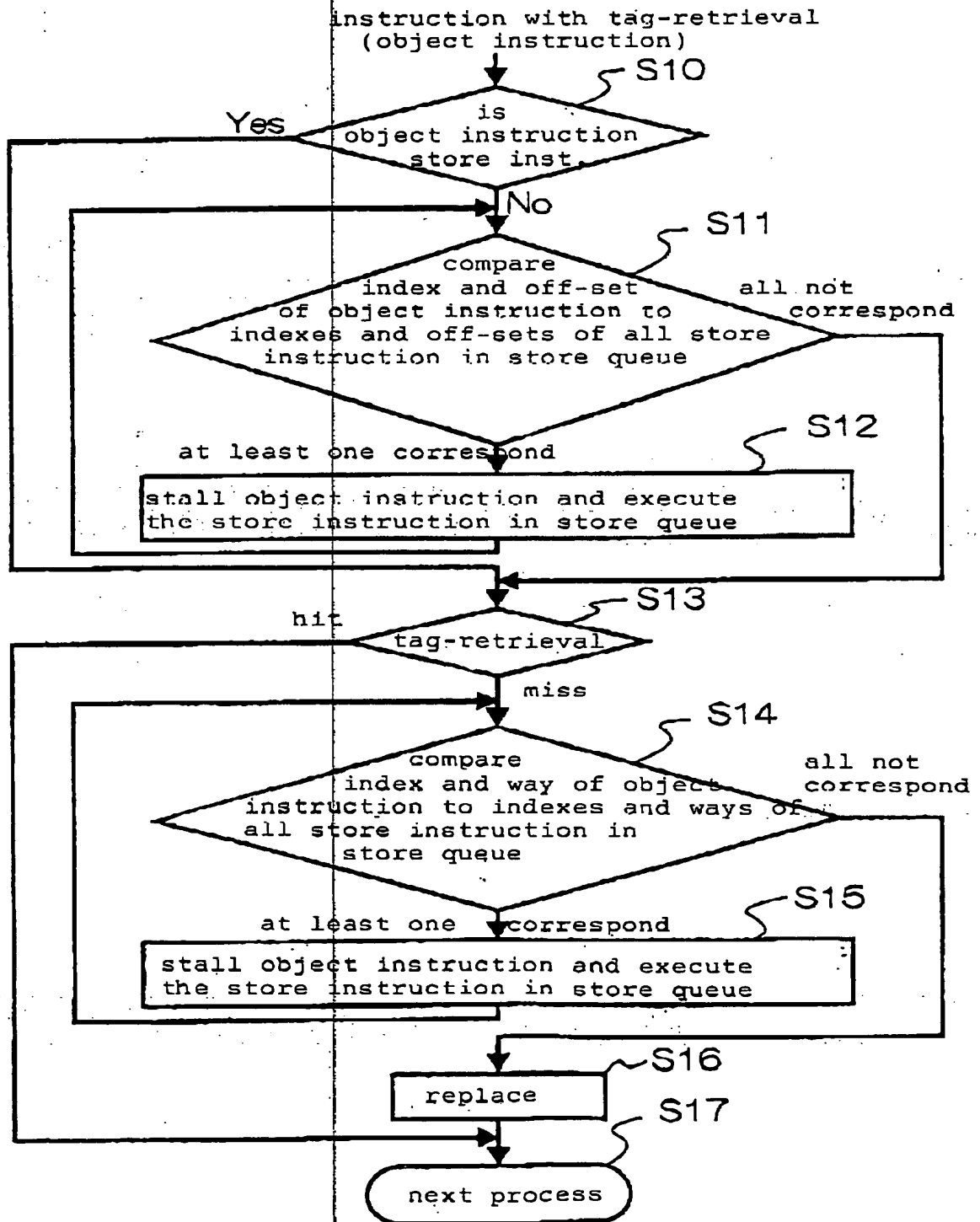


FIG. 9



105871.013002

FIG. 10



10058771.013002

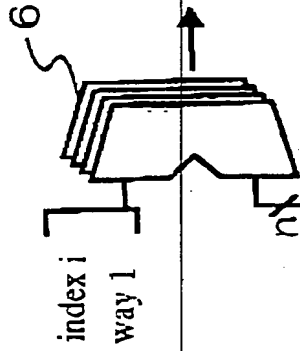
FIG. 11

lag-memory

index

| | | |
|---|------------------|------------------|
| | ... | ... |
| 1 | page frame no. A | page frame no. B |
| | ... | ... |
| 2 | | |
| 1 | | |
| 0 | | |
| | way 0 | way 1 |

page frame no. A \neq page frame no. C
 page frame no. B \neq page frame no. C
 tag-retrieval : miss
 replace object : way = 1



| ID | page frame no. | index | off-set | way | |
|-----|------------------|-------|---------|-----|-----|
| 0 | | i+1 | | | ... |
| 1 | page frame no. B | i | x | 1 | ... |
| 2 | page frame no. A | i | y | 0 | ... |
| ... | ... | ... | ... | ... | ... |
| n-1 | | | | | ... |

load instruction
 page frame no. C
 index "y"
 off-set "z"

FIG. 12

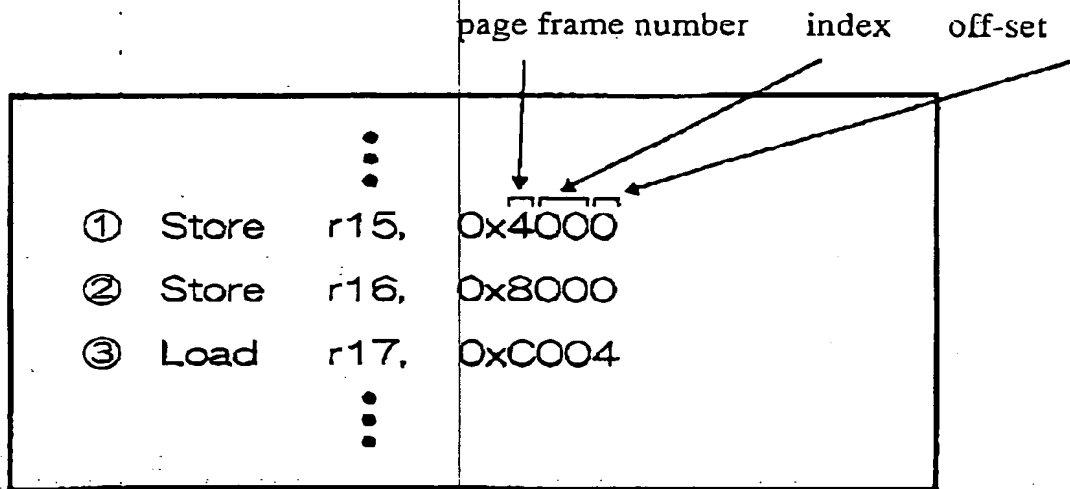


FIG. 13

| | | | object way | way index "00" way 0 / way 1 | result |
|---|---------|-------------------------------|---------------|---------------------------------|--------|
| a | ① Store | tag-retrieval : miss | 0 | indefinite 8 | 0 |
| b | | replace | 0 | 4 8 | 0 |
| c | ② Store | tag-retrieval : hit | 1 | 4 8 | 0 |
| d | ③ Load | tag-retrieval : miss | 0 | 4 8 | 1 |
| e | ① Store | write | 0 | 4 8 | 1 |
| f | | replace (write-back + refill) | 0 | C 8 | 0 |

10058771.013001

FIG. 14A

| | | |
|---------|------|--------|
| ① Store | r15. | Ox4000 |
| ② Load | r17. | Ox4128 |

FIG. 14B

| | | | | |
|---------|------|--------|---|-------|
| ① Store | r15. | Ox4000 | → | way 0 |
| ② Store | r16. | Ox8000 | → | way 1 |
| ③ Load | r17. | OxC004 | → | way 0 |

FIG. 15A

- | | | | |
|---|-------|------|--------|
| ① | Store | r15, | 0x4000 |
| ② | Load | r17, | 0x4000 |

FIG. 15B

- | | | | |
|---|-------|------|--------|
| ① | Store | r15, | 0x4000 |
| ② | Load | r17, | 0x8000 |